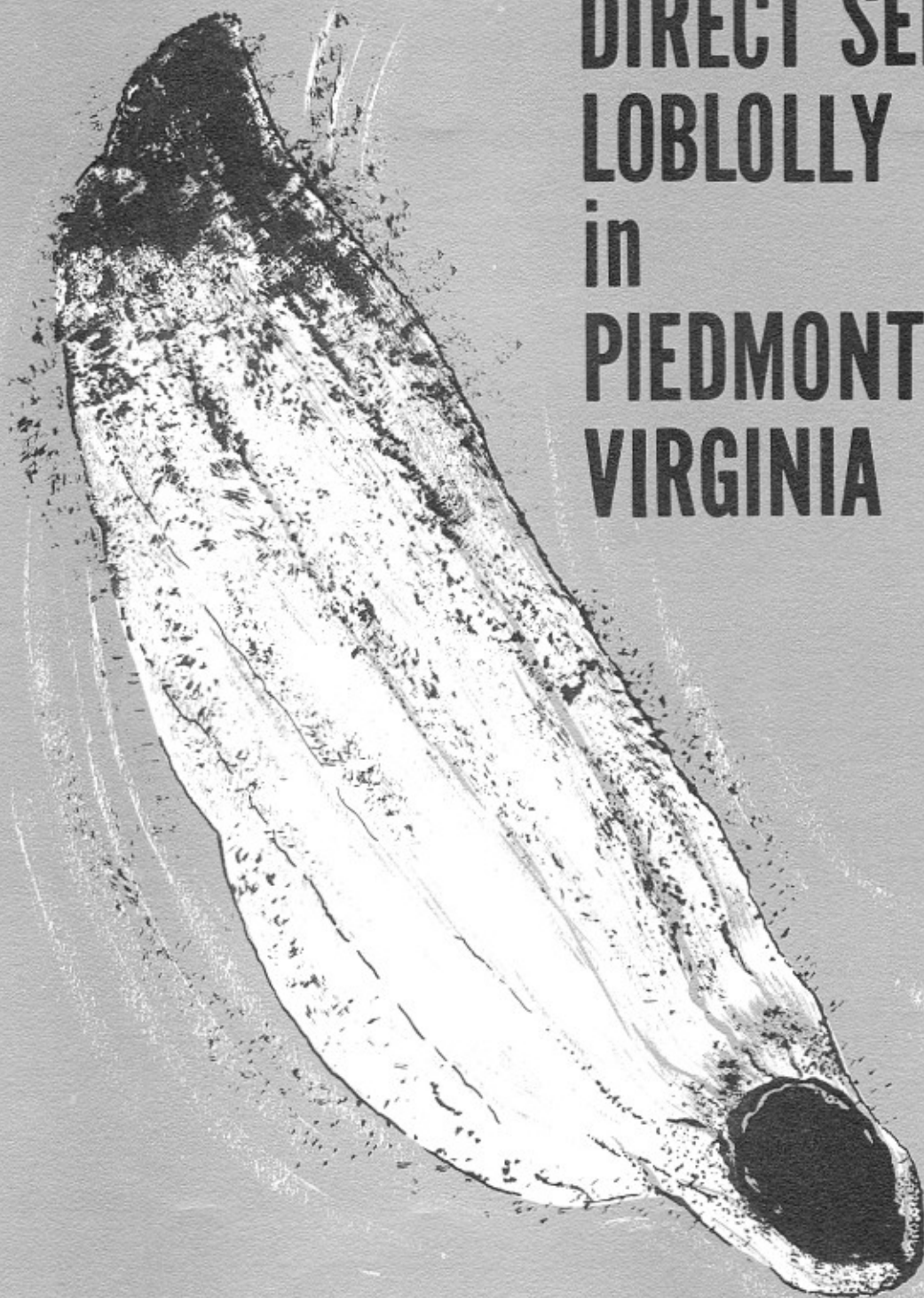


DIRECT SEEDING LOBLOLLY PINE in PIEDMONT VIRGINIA



Virginia Division of Forestry

Department of Conservation and Economic Development



Direct Seeding Loblolly Pine in Piedmont Virginia

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VIRGINIA DIVISION OF FORESTRY

INTRODUCTION

Direct seeding as a reforestation method is not new. Due to its relative ease and simplicity direct seeding has attracted interest for some time. The development of fairly effective chemicals for protecting pine seed from birds and rodents has enhanced its appeal and provides another acceptable reforestation practice.

To date, small landowners in Virginia have made little use of direct seeding. However, recent trends toward labor shortages, which make it difficult to hire and hold tree planting crews, may induce more landowners to consider direct seeding.

Beginning in 1961 the Virginia Division of Forestry established a series of loblolly pine direct seeding studies on the Appomattox-Buckingham State Forest. The general purpose of these studies was to test direct seeding as a reforestation method and, more specifically, to test different sowing dates and rates for the central piedmont. This report describes these loblolly pine direct seeding studies and gives their results.



GENERAL

All of the loblolly pine direct seeding studies were established on cutover woodland which had been cleared and then disked to expose as much mineral soil as possible.

The soils are in the Tatum and Nason series. These are commonly occurring soils in the central piedmont. They are well-drained soils with very

fine sandy loam to silt loam top soil. These soils are inherently low in natural fertility.

Separate seed lots were used for each year and seed tests made to determine the number of seeds per pound and germination percent. The summary which follows gives the results of the seed testing:

Year Sown	No. Seeds per Pound	Germination percent
1961	19,040	74
1962	21,206	78
1963	19,227	76
1964	20,525	87

All seeds used in the study were treated¹ with Arasan 75, Endrin 50-W, Dow Latex 512-R, and aluminum flakes. The stratified seed was stratified in polyethylene bags for 25 days.

The plots were hand sown using a cyclone seeder.

Final seedling counts were not made until the third growing season after sowing. Within each plot a sample of 100 mil-acres (ten transects of 10 mil-acres each) were taken in order to arrive at an estimate of the total number and percent stocking of loblolly pine seedlings.



The Study Area was lightly Bulldozed and disked.



The seed was sown with a cyclone seeder.

1. Amounts of material used based on treatment of 100 pounds of dry seed are: Arasan 75, 2.4 gallons; Endrin 50-W, 2.5 pounds; Dow Latex 512, 12 ounces; and Aluminum Flakes, 1.9 ounces.

STUDIES AND RESULTS

Study A (1961-1962-1963)

Direct seeding results vary from year to year. Therefore, a three year loblolly pine direct seeding study was established on the Appomattox-Buckingham State Forest beginning in 1961 and continuing through 1963.

Each year 8 different treatments were replicated 3 times using one acre square plots for a total of 24 plots each year. The treatments included the

sowing of non-stratified seed at one-half and one pound per acre rates in early January and February and stratified seed at the same rates in mid-March and April.

The results are summarized in Table 1 and are shown graphically in Figures 1 and 2. The results of the statistical analyses¹ are given.

TABLE 1

Treatment	No. of Seedlings per Acre			Percent Stocking		
	1961	1962	1963	1961	1962	1963
Early Jan., NS 1/2 lb.	2,090	743	293	74	44	23
Early Jan., NS 1 lb.	4,287	1,747	640	88	67	43
Early Feb., NS 1/2 lb.	2,303	547	550	77	37	38
Early Feb., NS 1 lb.	4,287	1,547	910	90	63	51
Mid Mar., S 1/2 lb.	2,067	547	663	78	33	44
Mid Mar., S 1 lb.	3,357	1,100	813	85	59	51
Mid Apr., S 1/2 lb.	1,913	737	387	76	42	30
Mid Apr., S 1 lb.	3,623	1,493	617	87	61	45

1961—Early sowings of non-stratified seed (January and February averaged) were better than later sowings using stratified seed (March and April averaged). Significant at 5 percent².

1962—No significant differences.

1963—Non-stratified seed sown in February gave better results than did non-stratified seed in January. Significant at 1 percent. Stratified seed sown in March gave better results than stratified seed in April. Significant at 1 percent.

1. Analysis of variance calculations and orthogonal comparisons were made using the number of seedlings per acre. 1 pound rates were significantly better than 1/2 pound rates for all studies beyond the 1 percent level. More complete statistical analyses are available upon request.

2. Significance at the 5 percent level means that the chances are 95 out of 100 that the difference is real and not due to sampling variation.

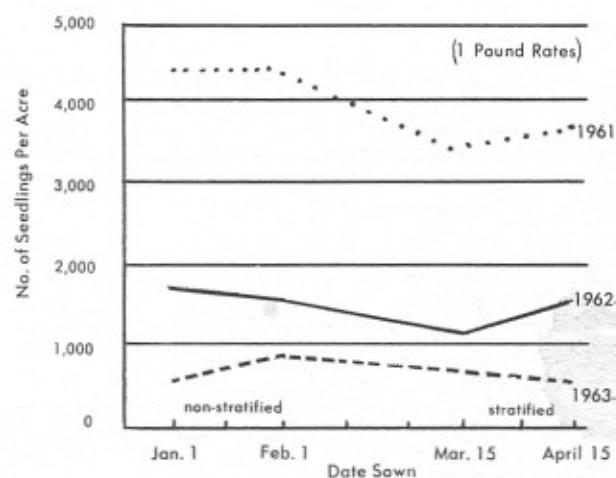


Fig. 1 No. of Seedlings Per Acre by Date Sown.

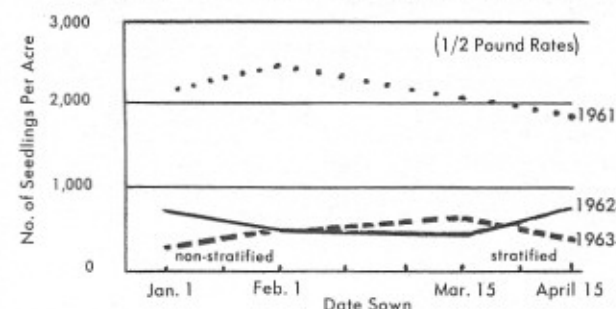


Fig. 2 No. of Seedlings Per Acre by Date Sown.

Study B (1963)

An additional study was installed in 1963 in order to test the effect of using non-stratified seed through mid-April. There were 4 treatments replicated 3 times using $\frac{1}{4}$ acre square plots. Non-

stratified seed was sown at the rate of one pound per acre in early January and February and mid-March and April.

The results¹ are given in Table 2.

TABLE 2.

Date Sown	(Non—stratified, 1 Pound per Acre)	
	No. Seedlings per Acre	Percent Stocking
Early January	920	51
Early February	840	53
Mid-March	1,057	55
Mid-April	640	46

No Significant differences.

Study C (1964)

This study was similar to Study A with two exceptions: only a 1 pound per acre sowing rate was tested, and non-stratified seed as well as stratified seed was sown in March and April. One quarter

acre square plots were used and the 6 treatments were replicated three times.

The results¹ are given in Table 3 and in Figure 3.

TABLE 3.

Date Sown	Stratified	(1 Pound per Acre)	
		No. Seedlings per Acre	Percent Stocking
Early January	Non-stratified	6,303	98
Early February	Non-stratified	5,360	93
Mid-March	Non-stratified	3,897	87
Mid-March	Stratified	4,017	94
Mid-April	Non-stratified	1,450	64
Mid-April	Stratified	1,763	73

- The effect of stratification was not significant.
- March sowings were better than April. Significant beyond the 1 percent level.
- January sowings were better than February. Significant at the $2\frac{1}{2}$ percent level.
- Early sowings (January and February) were better than later sowings (March and April). Significant beyond the 1 percent level.

1. Analysis of variance calculations and orthogonal comparisons were made using the number of seedlings per acre.

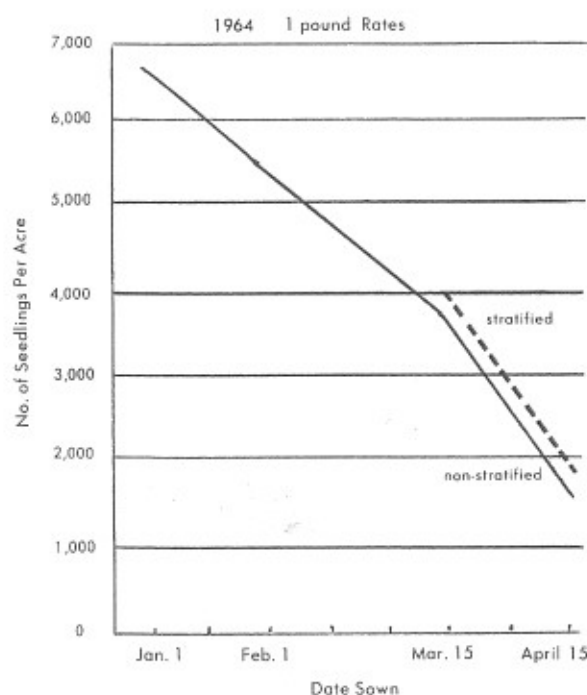


Fig. 3. No. of Seedlings Per Acre by Date Sown.

Study D (1964)

Another study was established in order to further compare non-stratified and stratified seed sown in March and April. From March 2 through April 27 both non-stratified and stratified seed were sown weekly for a total of nine sowing dates. A sowing

rate of 1 pound per acre was used.

One quarter acre square plots were used with each of the 18 treatments replicated three times.

The results are given in Table 4 and graphically illustrated in Figure 4.

TABLE 4.

Date Sown	(Sowing rate—1 pound per acre)			
	No. Seedlings		Percent Stocking	
	Stratified	Non-stratified	Stratified	Non-stratified
March 2	3,660	2,410	88	78
March 9	4,750	3,170	89	86
March 16	4,040	2,990	86	81
March 23	3,240	2,010	87	73
March 30	3,130	2,160	79	78
April 6	3,690	2,320	83	83
April 13	2,460	1,680	78	66
April 20	2,690	1,720	82	71
April 27	1,670	1,430	70	64

- The effect of stratification was significant¹ beyond the 1 percent level.
- The linear relationship between percent stocking and sowing date was significant beyond the 1 percent level.

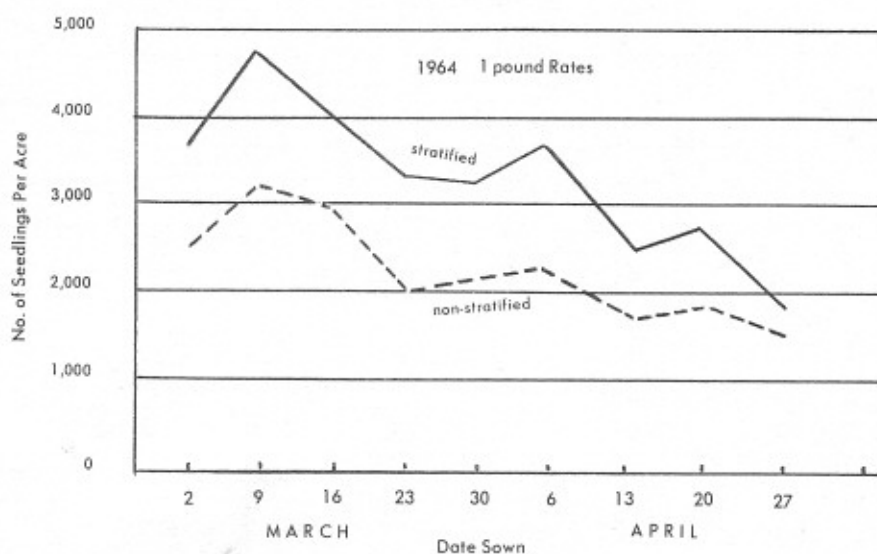


Fig. 4. No. of Seedlings Per Acre by Date Sown.

1. For this study the analysis of variance was made using Arcsin percent stocking because the number of seedlings could not be satisfactorily transformed.

SUMMARY AND CONCLUSIONS

- The one pound per acre sowing rates produced adequate stocking in 1961, 1962 and 1964. Only in 1963 was the stocking perhaps marginal for the one pound rate.
- One-half pound rates were tested in 1961, 1962 and 1963. Adequate stocking was obtained in 1961, while the stocking in 1962 was perhaps marginal and the stocking in 1963 could be considered inadequate.
- Of the four months tested, none consistently produced best results. Seed sown in January, February and March generally gave similar results. In 1964 April sowings gave poorer results than the other three months.
- The effect of stratification on seed sown in March and April was inconsistent. In both the 1963 studies and in one of the 1964 studies (Table 3) both stratified and non-stratified seed gave similar results. In the other 1964 study (Table 4) stratified seed produced considerably better results than non-stratified seed.

Therefore, the following conclusions are offered:

1. One pound rates were better than one-half pound.
2. January, February and March sowings gave approximately the same results. April sowings gave poorer results.
3. In March and April stratified seed gave better results than non-stratified seed.

WEATHER

Weather data for the four year study period is included below. The data presented were gleaned from Climatological Data as prepared by the U. S. Department of Commerce, Weather Bureau. The Buckingham weather station located approximately 10 miles distant from the study area was used for the precipitation data. Because temperature data are not recorded at the Buckingham station it was necessary to use the Farmville station, located some 17 miles distant.

WEATHER SUMMARY 1961-1964
(April through September)

Year		April	May	June	July	August	September	6 Mos. Total
1961	Rainfall (inches)	4.33	4.63	4.06	3.69	6.31	3.93	26.95
	Longest rain-free period (number of days)	8	6	5	6	13	12	
	Temperature, number of 90° F.+days	1	0	7	17	12	11	
	Average maximum temperature (°F.)	66.5	75.7	83.9	88.7	86.4	83.9	
1962	Rainfall (inches)	2.93	5.32	5.82	4.41	1.10	3.22	22.80
	Longest rain-free period (number of days)	16	6	5	11	9	5	
	Temperature, number of 90° F.+days	0	7	6	10	9	5	
	Average maximum temperature (°F.)	72.8	83.6	83.5	85.0	87.1	79.4	
1963	Rainfall (inches)	0.90	1.98	1.16	2.41	0.60	3.85	10.90
	Longest rain-free period (number of days)	16	6	8	13	6	7	
	Temperature, number of 90° F.+days	0	2	12	14	18	2	
	Average maximum temperature (°F.)	74.3	78.7	86.8	88.8	88.5	79.0	
1964	Rainfall (inches)	2.06	1.43	0.99	2.54	1.33	1.18	9.53
	Longest rain-free period (number of days)	4	8	10	7	7	11	
	Temperature, number of 90° F.+days	0	5	15	9	9	2	
	Average maximum temperature (°F.)	70.7	80.0	88.6	86.6	85.7	80.1	